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ANTONELLI, TERRY, STOUT & KRAUS, LLP
1300 NORTH SEVENTEENTH STREET
SUITE 1800
ARLINGTON, VA 22209-9889

EXAMINER

DI GRAZIO, JEANNE A

ART UNIT PAPER NUMBER

2871

DATE MAILED: 07/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/082,113

Applicant(s)

HIROTA ET AL.

Examiner

Jeanne A. Di Grazio

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-37 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 February 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: .

DETAILED ACTION

Priority

Priority to Japanese Patent Application No. 2001-298974 (Sept. 28, 2001) is claimed.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 109 and 110 (For example, Figures 1A and 1B, 9A and 9B). A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The Examiner wishes to suggest the following title.

The following title is suggested: "Polarization Direction of Incident Light Beam Perpendicular or Parallel to Liquid Crystal Molecular Orientation for Reduced Drive Voltage."

Claim Objections

Claims 1 and 16 objected to because of the following informalities: Line 6 of both claim 1 and 16 contain a typographical error, "lease" should be "least." Furthermore, following "lease" "substrate" should be made plural substrates. Appropriate correction is required.

Claim 28 objected to because of the following informalities: In the 4TH line of claim 28 (page 49), "diffract" should read "diffracts." In the 2^D line of claim 28 (page 50), "impinges"

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should read “impinge.” In 9TH line of claim 28 (page 50), “polarizee” should read “polarized.”

Appropriate correction is required.

Claim 29 objected to because of the following informalities: In the 4TH line of claim 29 (page 50), “diffract” should read “diffracts.” In the 8TH line of claim 29 (page 50), “impinges” should read “impinge.”

Claims 34 and 35 objected to because of the following informalities: In claims 34 and 35, the limitation “oblique to the liquid crystal display elements” is unclear. This is unclear because “liquid crystal display elements” as characterized in claims 1 and 16, refers to a number of elements and it is not clear as to what “oblique” specifically refers. For example, directions oblique to the liquid crystal display elements could refer to the optical axis of a light beam or a direction of LC orientation or the angle of inclination. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 16 rejected under 35 U.S.C. 102(e) as being anticipated by Kubo et al. (US 2001/0024257 A1).

Per claims 1 and 16: Referring to Figure 57, a liquid crystal display element comprising: a reflection substrate (1000) [0016], a transparent substrate (101, 121) [0137], and a liquid crystal layer interposed between said two substrates (30), wherein a plurality of pixels and active

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elements for driving the liquid crystal at the plurality of pixels, are incorporated to at least one of the two substrates [0009], characterized in that an optical axis of an incident light beam upon the liquid crystal layer is present in a plane which is substantially perpendicular to a direction of orientation of liquid crystal molecules on at least one of the two substrates (liquid crystal molecule, 30a)(referring to the left hand side of the Figure 57), and the incident light impinges upon the liquid crystal layer in a direction which is inclined by a predetermined angle to the direction of the normal line of the substrate (Figure 57).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2, 13, and 17 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Melnick et al. (US 6,348,959 B1).

Per claims 2, 13, and 17: Kubo has the LC layer driven by an electric field component which is mainly parallel to the substrate (Figure 1B) and switching made between directions of orientation of the LC molecules in two states (Figure 1B). Kubo does not appear to specify that a polarization direction of an incident light beam upon the LC layer is substantially perpendicular or parallel to the direction of LC molecular orientation; however, Melnick teaches that by choosing the orientation direction of the LC molecules on the side of a polarizing means to be substantially parallel to the direction of polarization of incident light or by choosing this orientation direction to be perpendicular to the polarization direction, it is only necessary to

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compensate for the birefringence due to a non-reorientable surface layer of LC on the side of the reflecting means (Col. 4, Lines 5-11). In Melnick, this configuration is chosen in part to reduce drive voltage and maintain high contrast and for faster switching (Col. 3, Lines 62-67 and Col. 4, Lines 1-11). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Melnick to reduce drive voltage while maintaining high contrast and for faster switching.

Claims 3-6, 18-21, 30, and 31 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Melnick et al. (US 6,348,959 B1) and further in view of Okada (US 6,542,211 B1).

Per claims 3, 4, 18, 19, 30, and 31: Kubo has the LC layer driven by an electric field component which is mainly parallel to the substrate (Figure 1B) and switching made between directions of orientation of the LC molecules in two states (Figure 1B). Kubo does not appear to specify homogeneous and homeotropic orientations; however, Okada has an LCD device and driving method and homogeneous and homeotropic LC orientations (Col. 3, Lines 16-40). In Okada, these alignments are useful for providing an LCD with a lower re-bending voltage and lower holding voltage for holding or retaining bend alignment (Col. 1, Lines 64-67). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Okada for a lower re-bending voltage and lower holding voltage.

Per claims 5, 6, 20, and 21: It may be implied in Kubo, that an angle between an optical axis of an optical path in the LC layer and the direction of the normal line of the substrate is set to be larger than a total reflection angle upon emanation of the light beam from the substrate into the air (Figure 57) for a display that uses a phenomenon that the polarization or amount of light

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passing through the LC layer changes along with the change in the orientation of the LC layer [0137] for the purpose of reducing drive voltage.

Claims 7, 8, 22, and 23 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Melnick et al. (US 6,348,959 B1) and further in view of Okada (US 6,542,211 B1) and further in view of Kitagishi Nozomi (JP-07-318861).

Per claims 7, 8, 22, and 23: Kubo does not appear to specify that an angle between an optical axis of an optical path in the LC layer and the direction of the normal line of the substrate is set to be not less than a Brewster angle between the substrate and the air; however, Nozomi has a polarizing element and projector for which incident light is approximately the same as a Brewster angle with an optical axis (PAJ). In Nozomi, this configuration is used for polarizing and light separating efficiency. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Nozomi for polarizing and light separating efficiency.

Claims 9-12, and 24-27 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Melnick et al. (US 6,348,959 B1) and further in view of Okada (US 6,542,211 B1) and further in view of Ichikawa et al. (US 6,473,144 B1).

Per claims 9-12, and 24-27: Kubo does not appear to specify a hologram element (or diffraction grating) for pixels whereby p-polarized light is not substantially diffracted, but an s-polarized light beam generated after modulation by the LC layer is diffracted to a direction substantially perpendicular to the LC element; however, Ichikawa has a hologram color filter including a blazed holographic diffraction grating for a hologram that has both a dispersing and converging function or only a dispersing function (Col. 3, Lines 45-53). In Ichikawa, s-polarized

light is incident on the hologram color filter (Col. 4, Lines 55-56) and appears to be substantially perpendicular to the LC element (Figure 1). In Ichikawa, the hologram color filter diffractively disperses incident light to emanate light rays in different wavelength regions at a predetermined spatial period (Col. 2, Lines 53-65) for excellent color reproduction and to prevent uneven color (Col. 5, Lines 5-8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Ichikawa for excellent color reproduction and to prevent uneven color.

Claims 14, 15, 32, and 33 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Melnick et al. (US 6,348,959 B1) and further in view of Tanaka (US 5,895,108).

Per claims 14, 15, 32, and 33: Kubo does not appear to specify ferroelectric and antiferroelectric material to be used as the liquid crystal material; however, Tanaka suggests that an antiferroelectric and ferroelectric liquid crystal may be used because they require a low voltage when switching among antiferroelectric and ferroelectric states (Col. 2, Lines 45-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Tanaka for reduced drive voltage when switching among various liquid crystal states.

Claims 28 and 29 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Melnick et al. (US 6,348,959 B1) and further in view of Okada (US 6,542,211 B1) and further in view of Inoko (US 6,417,941 B1).

Per claims 28 and 29: Kubo does not appear to specify incident and emergent side hologram elements where the incident side hologram diffracts an emergent light beam

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substantially perpendicular to a substrate and an emergent side hologram diffracts the emergent light beam having a polarization orthogonal to the polarization of the incident light beam; however, Inoko has a component of light passing through the first hologram element after diffraction and the polarization directions are perpendicular to each other (Col. 2, Lines 10-31). Inoko has such a configuration for splitting of light with high accuracy and to prevent the unnecessary absorption of light that may internalize to heat (Id.). Such a display is reliable and has a long service life (Id.). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Inoko for accurate light splitting without the unnecessary absorption of light and for a display that is reliable and that has a long service life.

Claims 34-37 rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. (US 2001/0024257 A1) in view of Miyake et al. (US 5,729,306).

Per claims 34-37: Kubo has, referring to Figure 57, a liquid crystal display element comprising: a reflection substrate (1000) [0016], a transparent substrate (101, 121) [0137], and a liquid crystal layer interposed between said two substrates (30), wherein a plurality of pixels and active elements for driving the liquid crystal at the plurality of pixels, are incorporated to at least one of the two substrates [0009], characterized in that an optical axis of an incident light beam upon the liquid crystal layer is present in a plane which is substantially perpendicular to a direction of orientation of liquid crystal molecules on at least one of the two substrates (liquid crystal molecule, 30a)(referring to the left hand side of the Figure 57), and the incident light impinges upon the liquid crystal layer in a direction which is inclined by a predetermined angle to the direction of the normal line of the substrate (Figure 57).

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Kubo does not appear to have a color separation and color synthesizing optical system; however, Miyake has a light splitting and synthesizing device as illustrated, for example, in Figure 18. In Miyake, the light source optical axis and projection lens are on different levels and parallel (Figure 18 and Figure 35).

Miyake has a polarized beam splitter for splitting a white light into polarized beams having polarizations different from each other (Col. 4, Lines 49-54) corresponding to three primary colors (Col. 17, Lines 44, 51, and 60) and the colors are incident on the LCD panels (Figure 18, LCDs 222, 223, and 224) obliquely on hologram plates (Figure 14).

In Kubo, the display is produced by changing polarization or amount of light passing through a liquid crystal layer based on changes in the LC molecular orientation [0137] such that a high drive voltage is not required.

In Miyake, the invention is directed to a light splitting and synthesizing device for aligning different polarization directions of the light emitted by a light source to prevent chromatic aberration and for a high luminance display that is small and easy to produce (Col. 6, Lines 35-42).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kubo in view of Miyake for a splitting and synthesizing device requiring a low drive voltage that can be manufactured easily and that prevents chromatic aberration.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeanne A. Di Grazio whose telephone number is (703)305-7009.

The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim, can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703)746-8741 for regular communications and (703)746-8741 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Jeanne Andrea Di Grazio

Robert Kim, SPE

JDG

July 8, 2003


TOANTON
PRIMARY EXAMINER